Geomorphological Interpretation of High Resolution DEMs from the GIS Desktop: A Case Study in Locating Sediment Sources to Lake Forest Lake, and Mobile Bay, Baldwin County, Alabama.

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What's a River Guy Doing in a Lakes Session?

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Measuring sediment loads in a stream…

to help out with a reservoir volume loss problem

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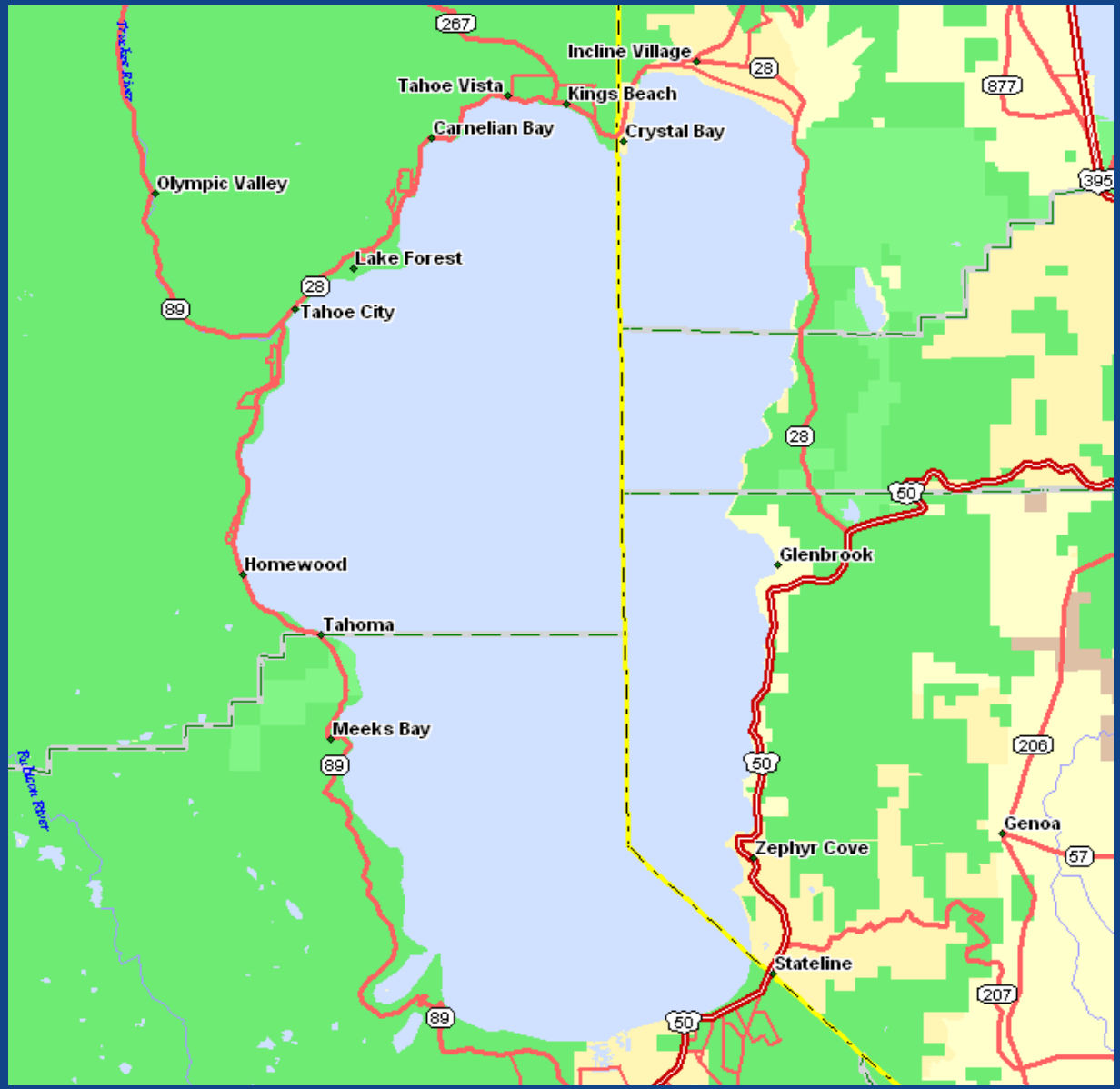
Assessed major tribs to Lake Tahoe for sources of fine sediment…



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as part of a lake clarity study

If you get a project at Lake Tahoe, be sure and bring the family.

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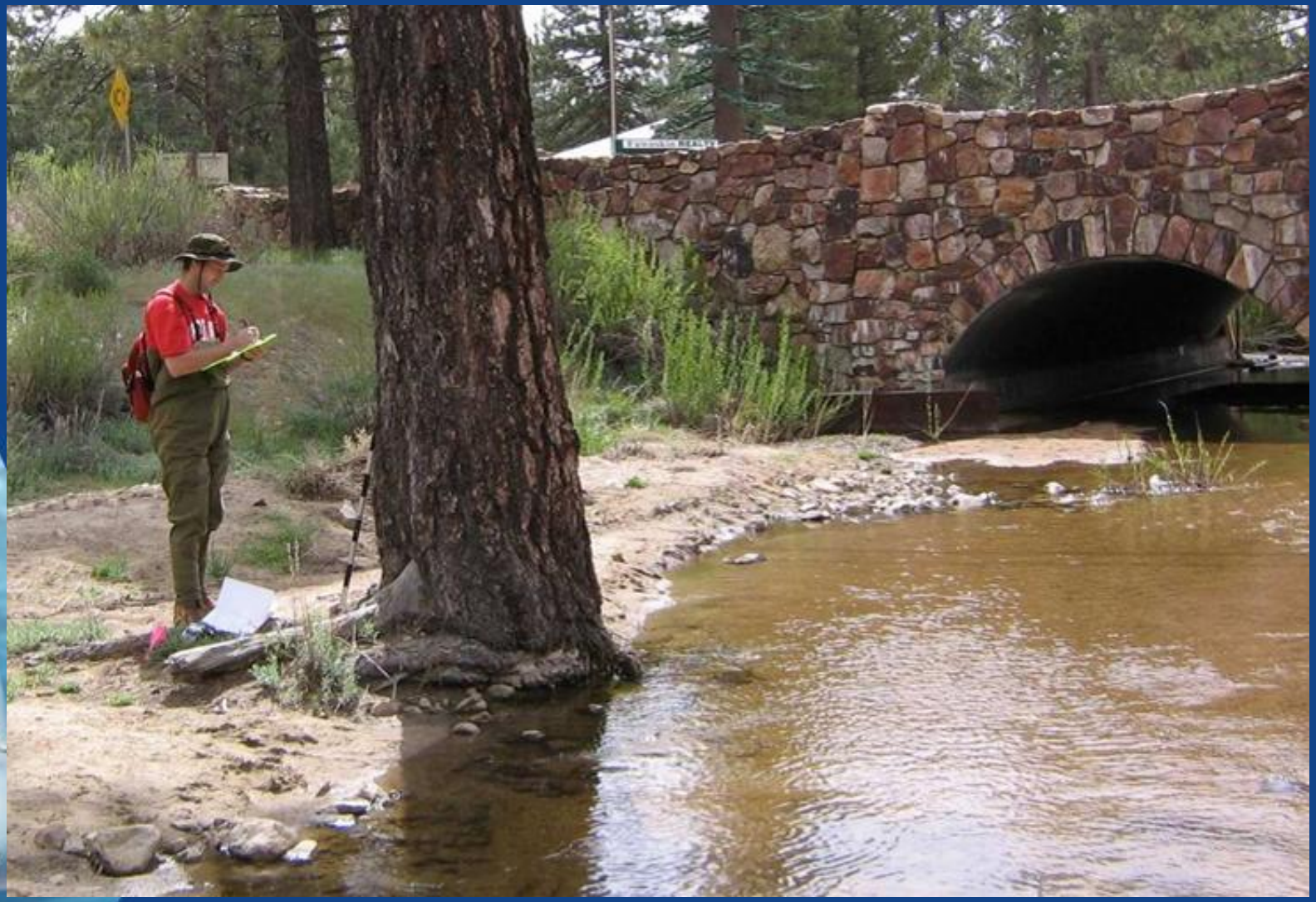
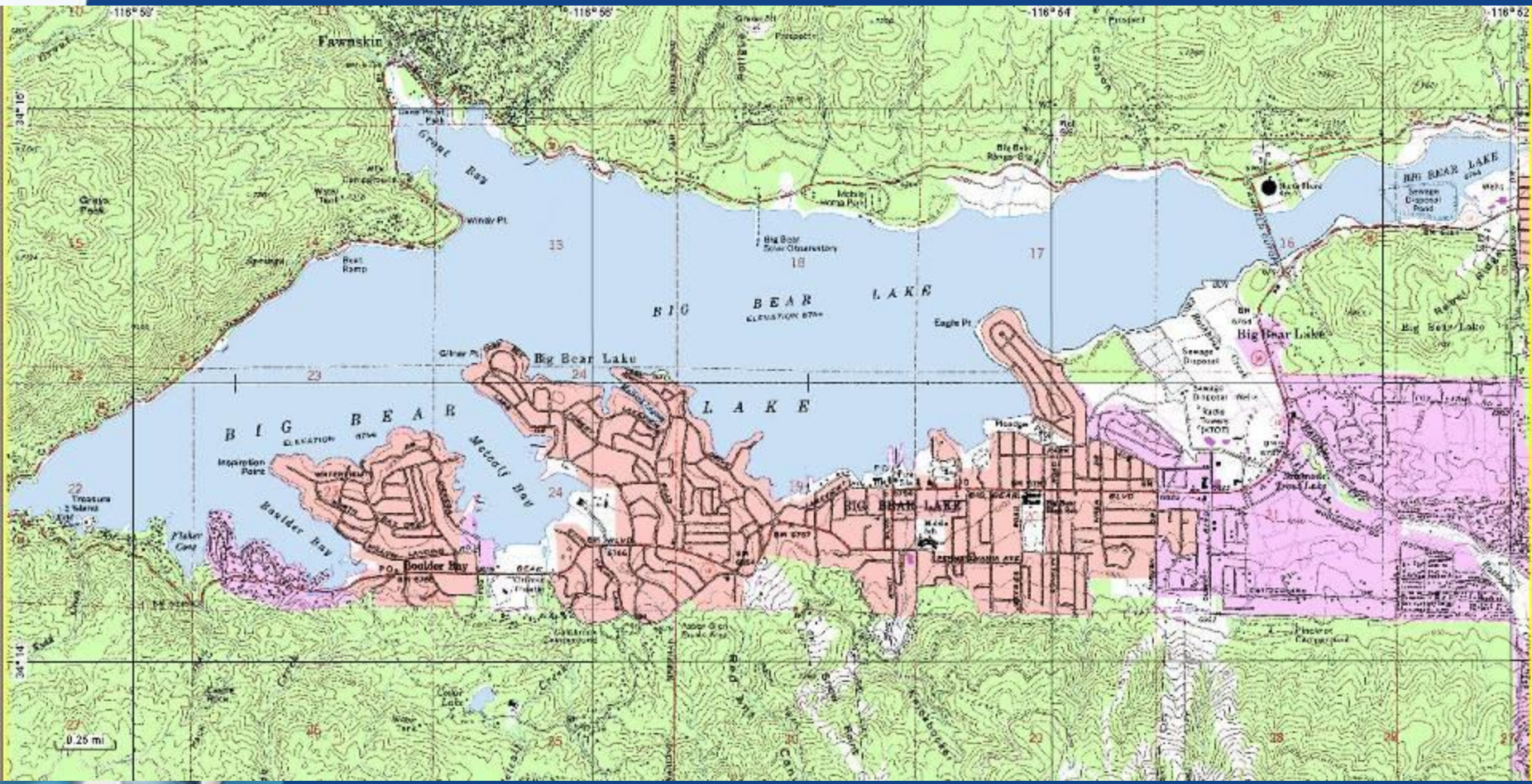
Assessed tributaries to Big Bear Lake, California…



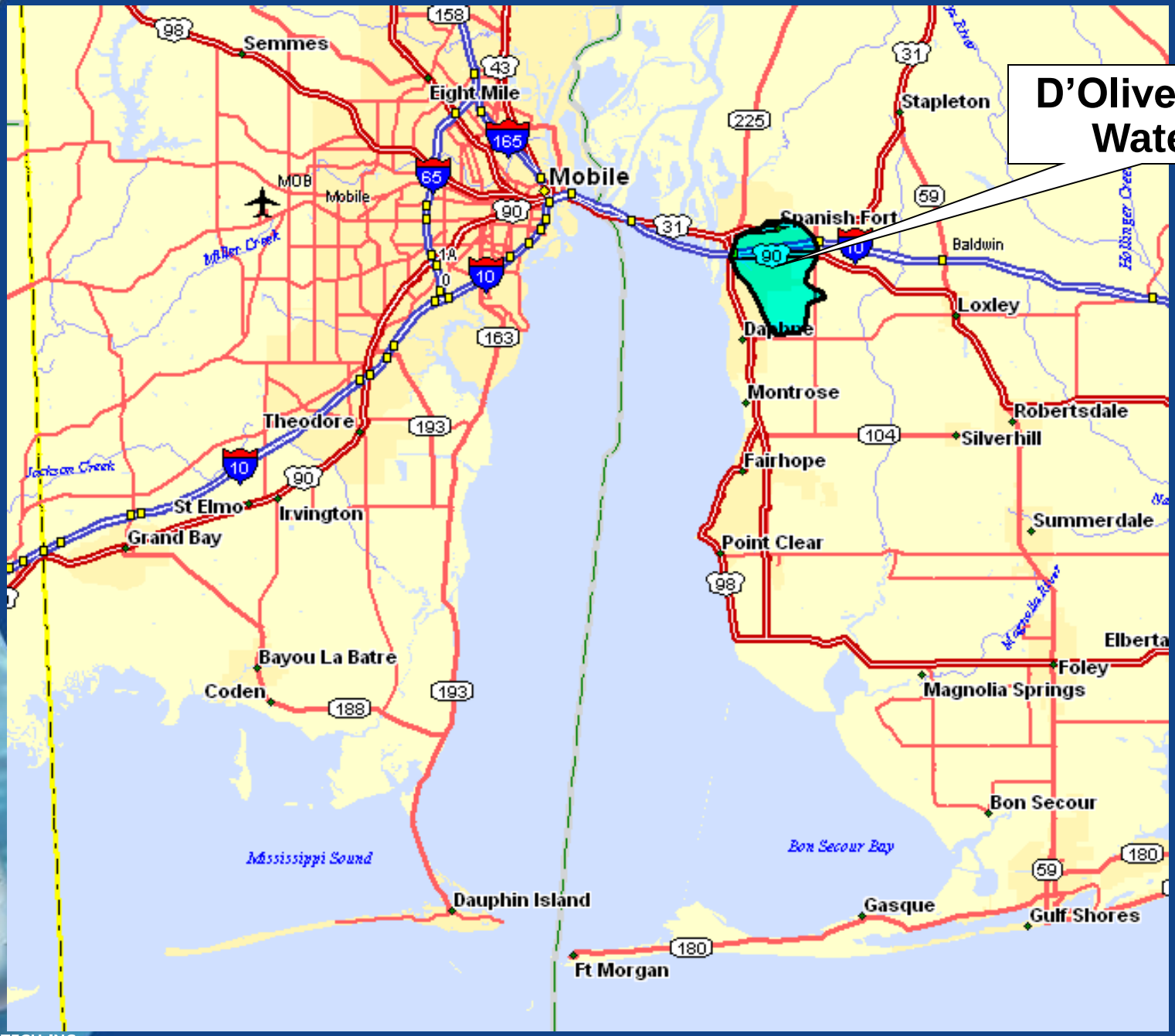
for natural and human induced sources of phosphorus to the lake



Lake Sedimentation Impacts

- Burial of aquatic habitat
- Reduction of reservoir volume
- Nutrient and chemical pollutants attached to sediment
- Loss of recreation
- Reduced aesthetic of lake appearance

Case Study: Locating Sediment Sources to Lake Forest Lake and Mobile Bay



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~10 sq-mi watershed

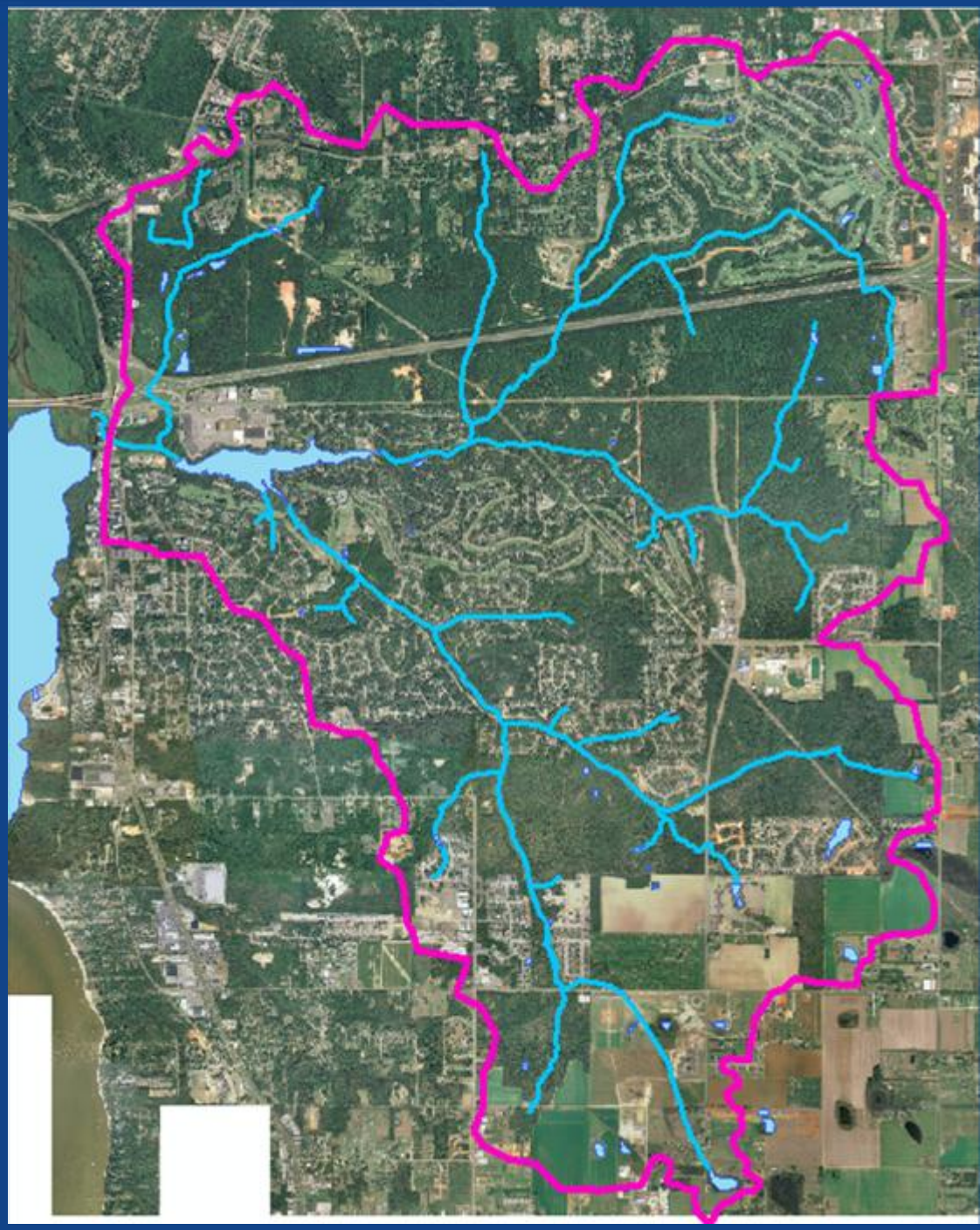
D'Olive and Tiawassee Creeks drain to Lake Forest Lake.

Lake Forest Lake outlet to Mobile Bay.

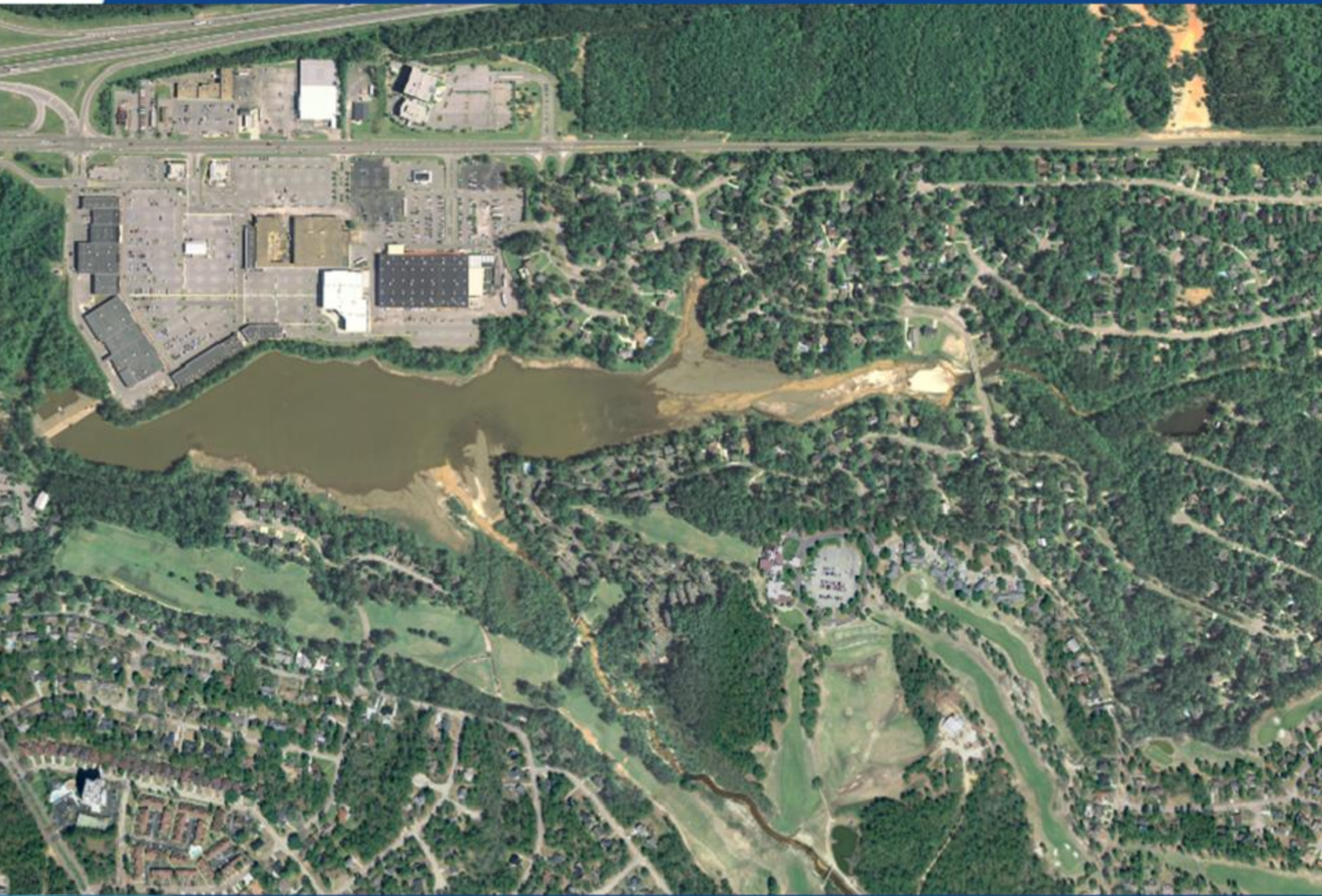
Lake and Bay impacted by sedimentation.

~720,000 tons of sediment deposited in lake between 1965 and 1980.

~300,000 tons of sediment passed on to Mobile Bay.

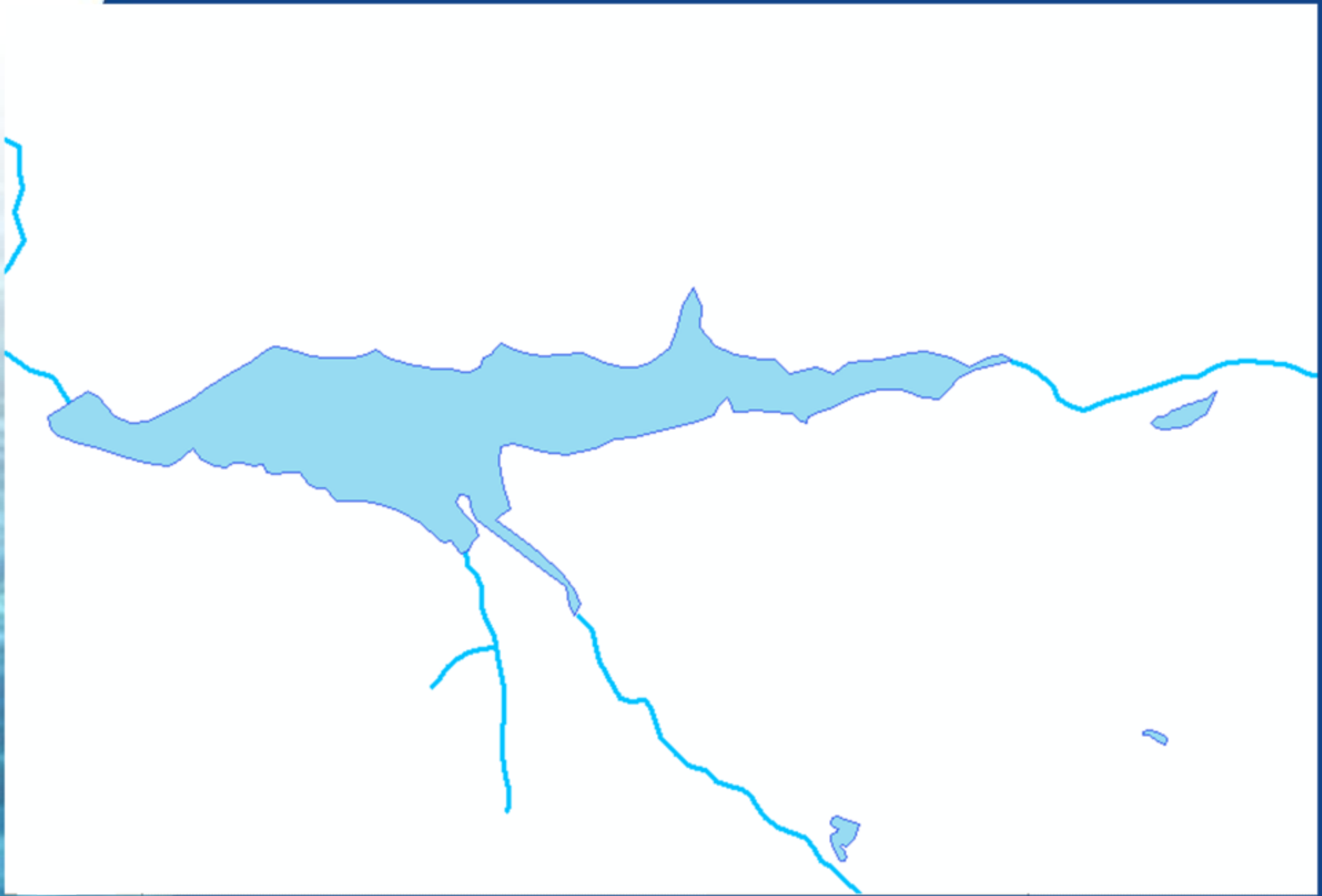


Aerial Photos GIS Layer



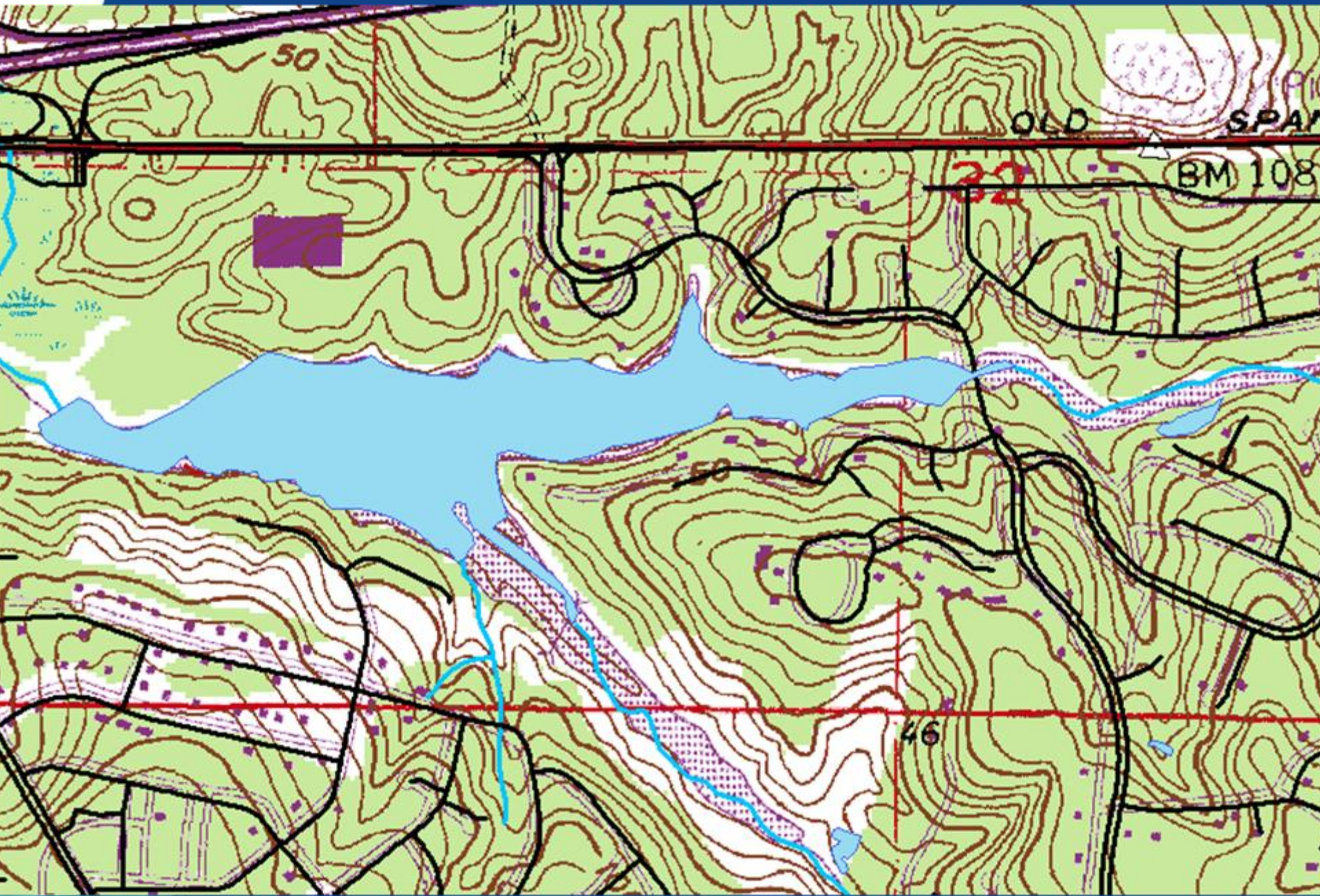
Waterbodies GIS Layer

Streams GIS Layer

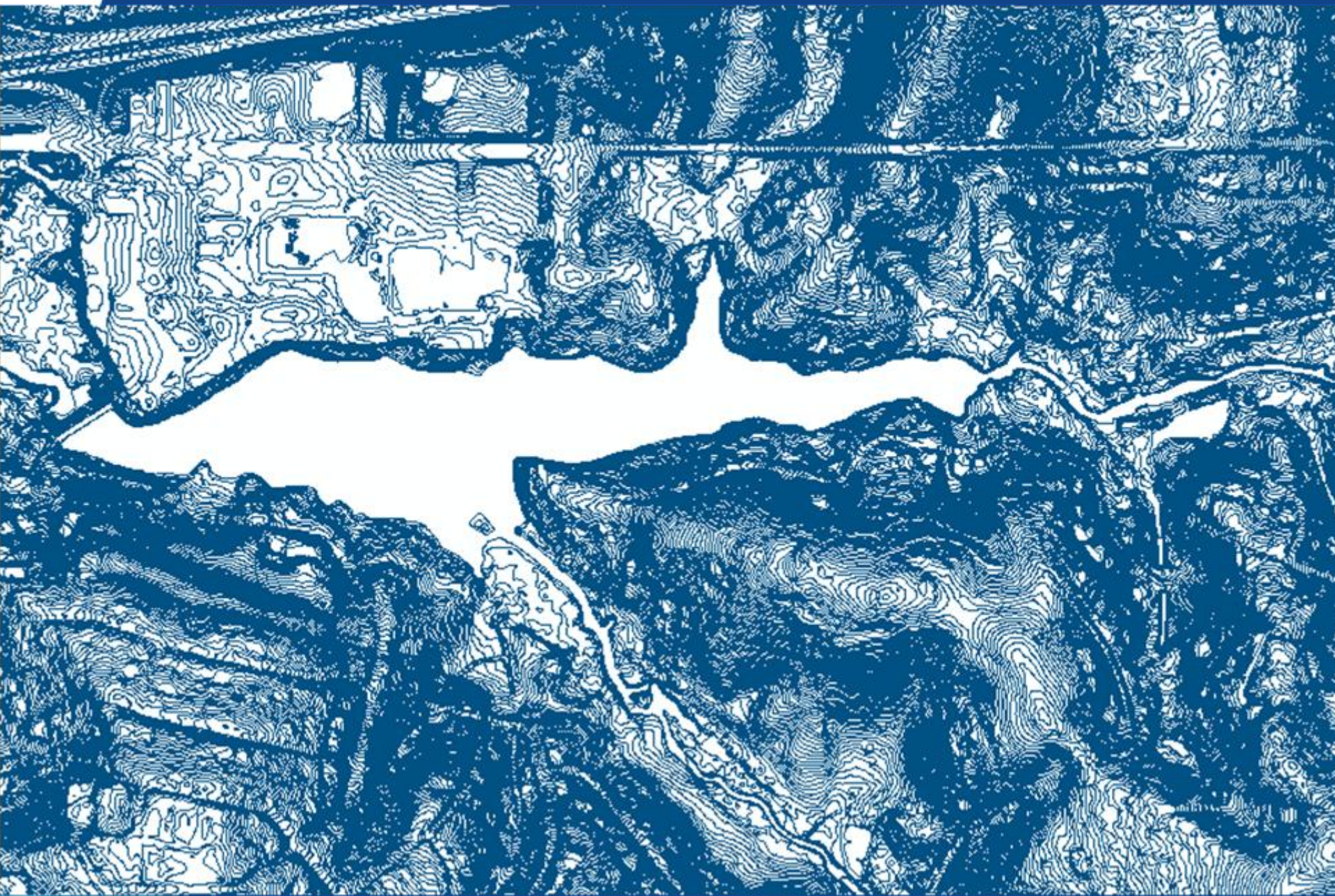


Roads GIS Layer

USGS 7.5 Minute Topos GIS Layer



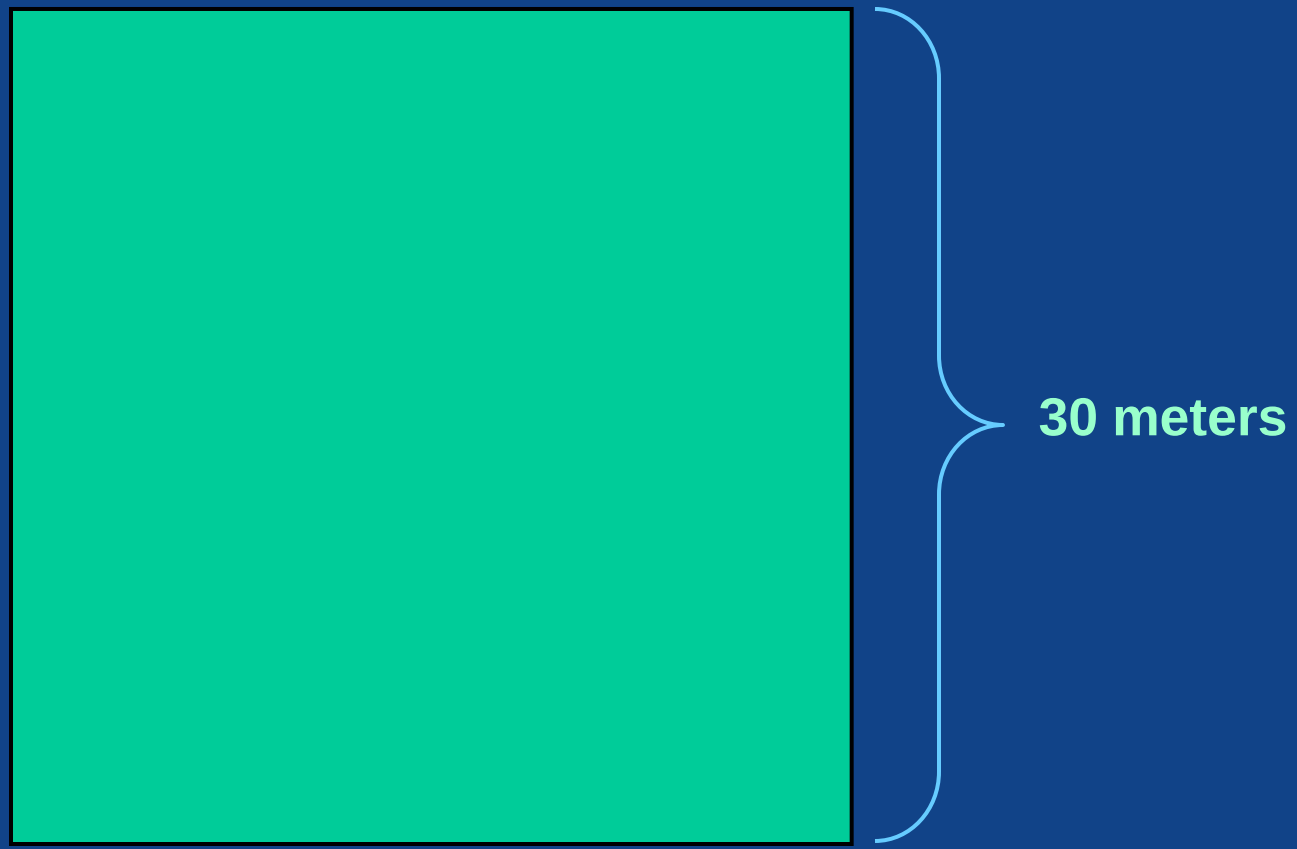
One Foot Interval Elevation Contours GIS Layer



What is a High Resolution DEM?

Standard Resolution:

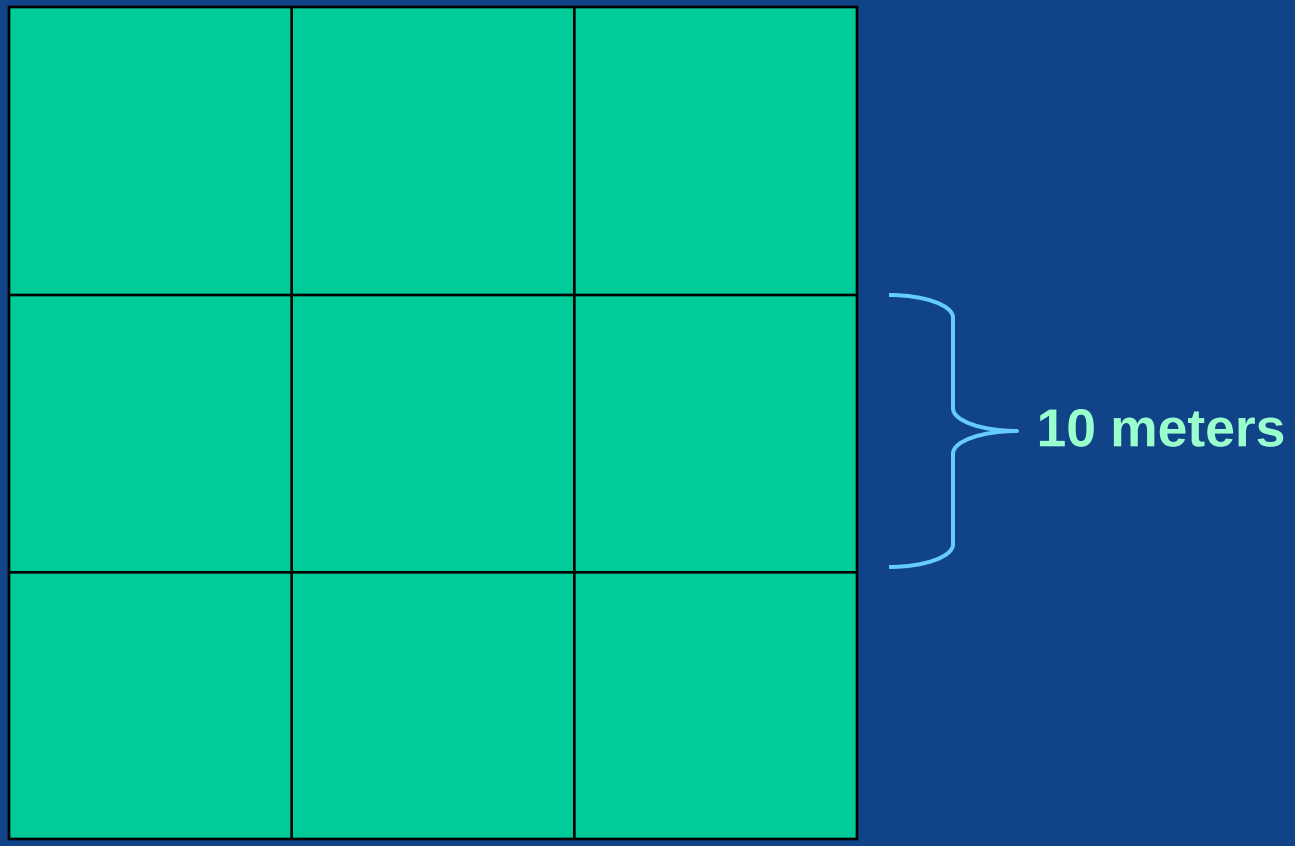
30 m grid (1 arc sec) from the USGS



In special cases:

10 m grid (1/3 arc sec) from the USGS

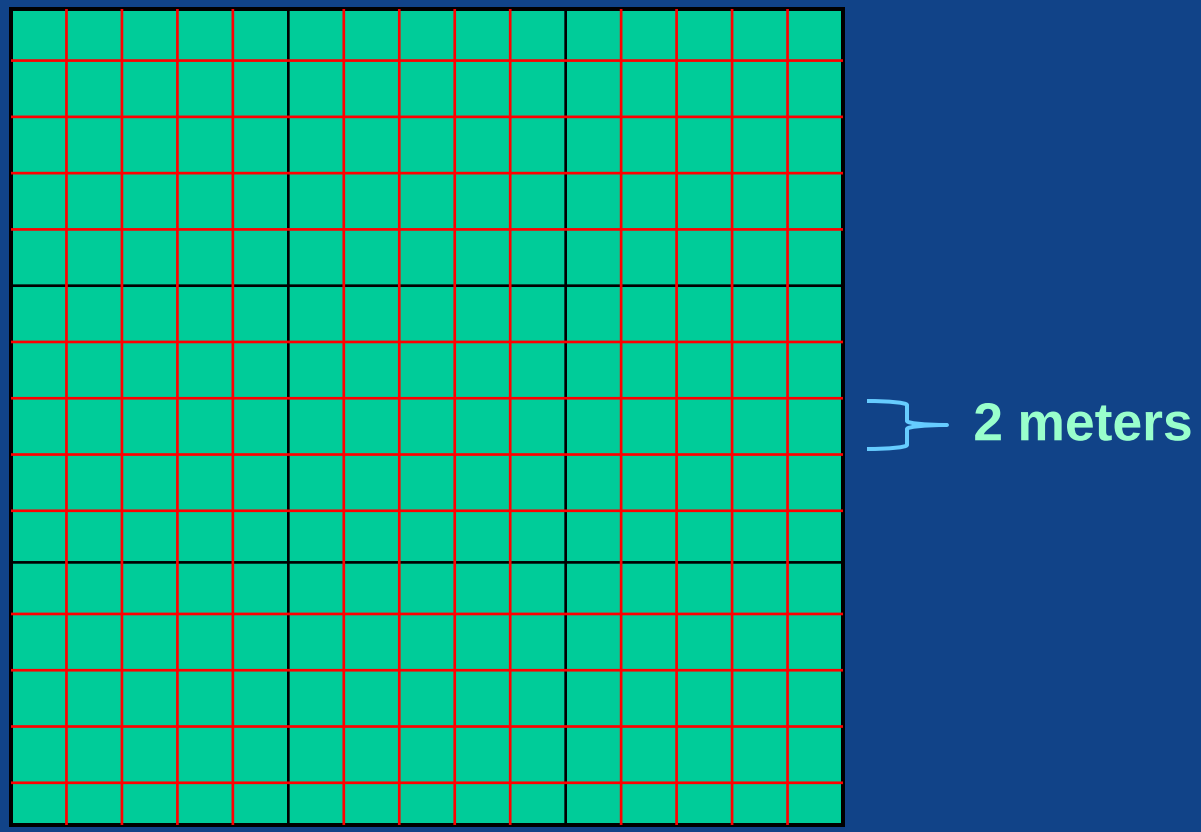
9 x the resolution of a 30 m grid.



High resolution DEM:

1 to 2 m grid = 1 to 2 foot contour interval

2 m grid = 25 x the resolution of a 10 m grid



Where Does a High Resolution DEM Come From?

Created using LiDAR (Light Detection and Ranging)

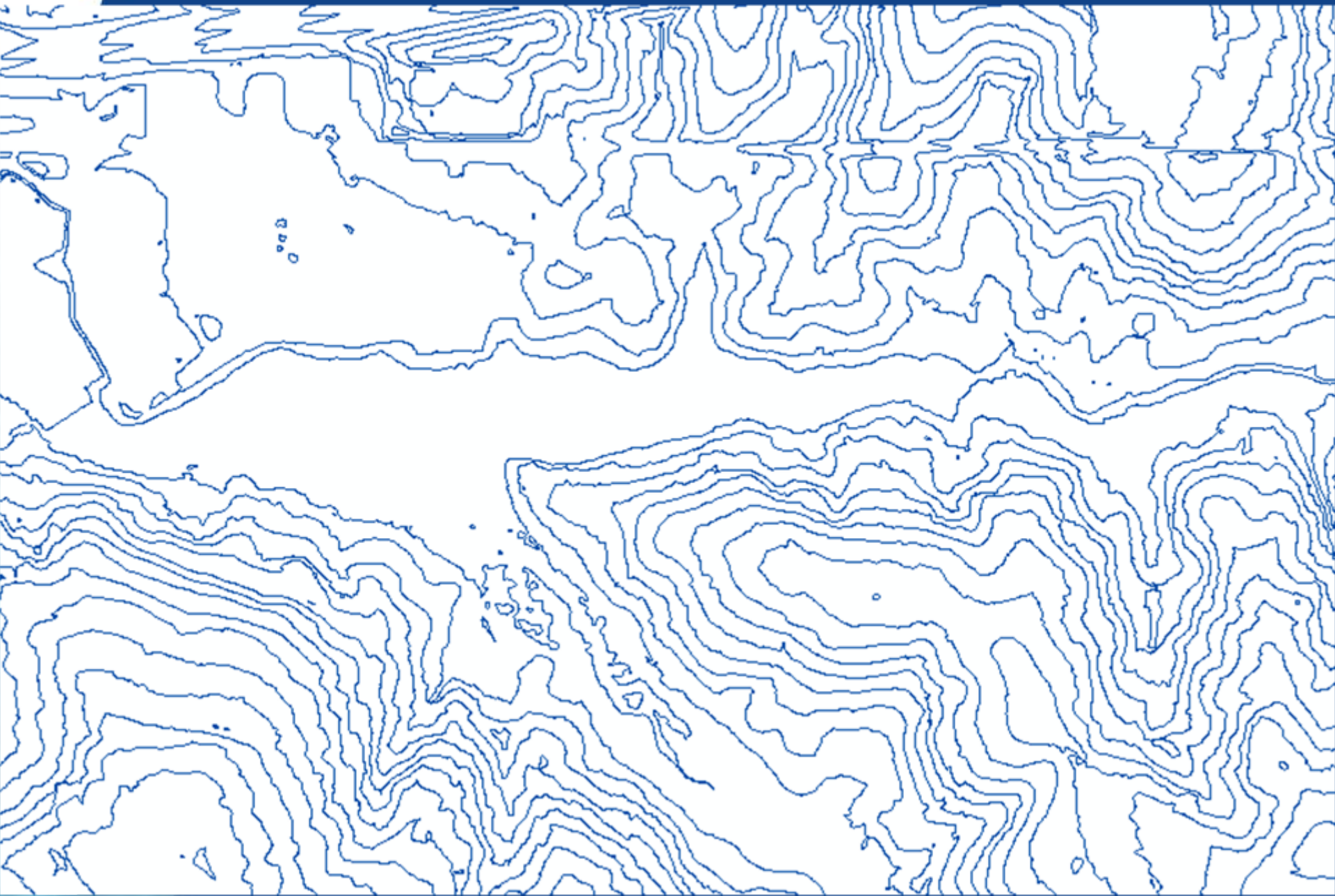
- Aircraft collects 10,000 to 25,000 elevations per second via laser. Computer distills the data.

Affordable over the past decade by governments of large population centers.

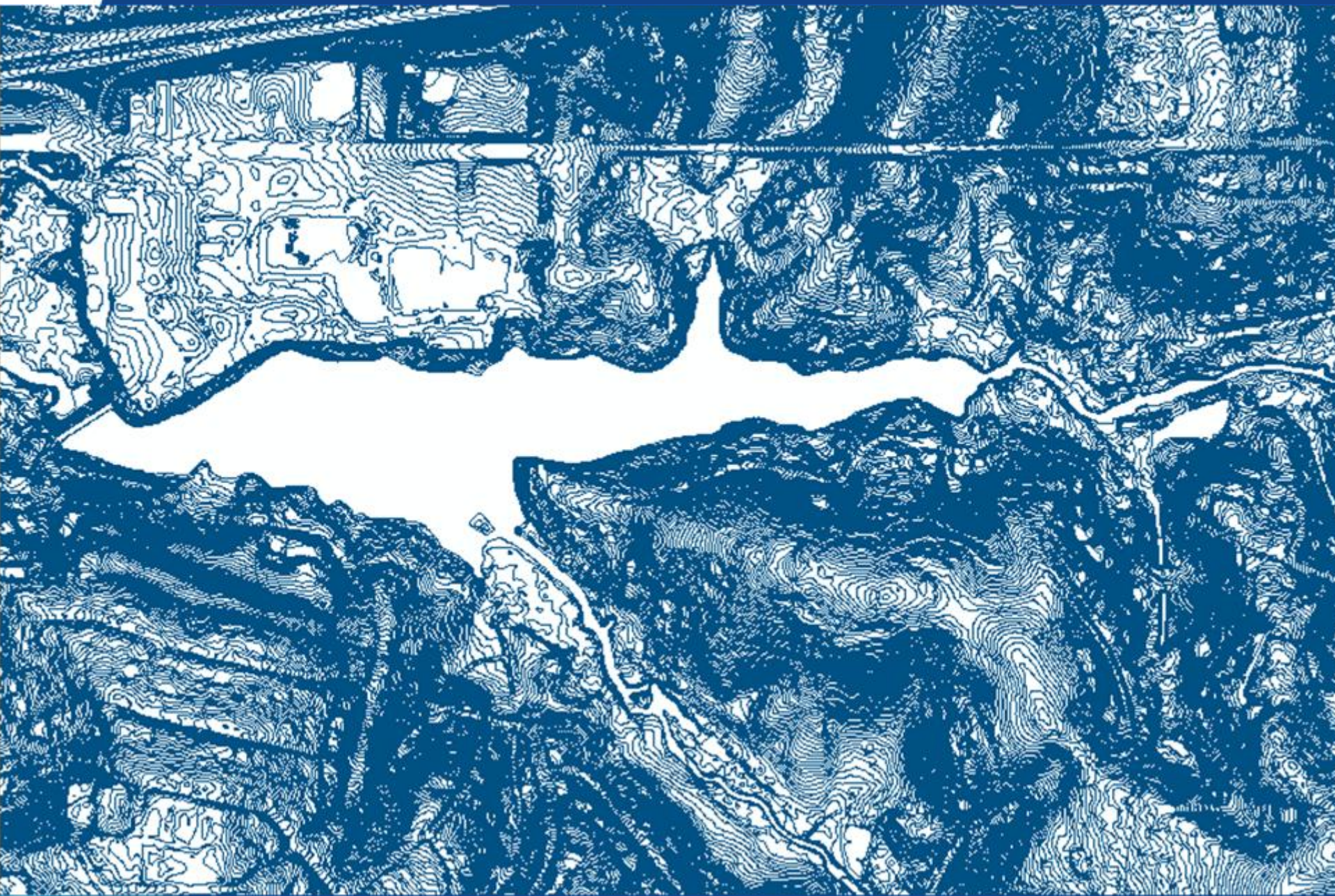
Data now becoming more available.

- Frequently provided by local government.

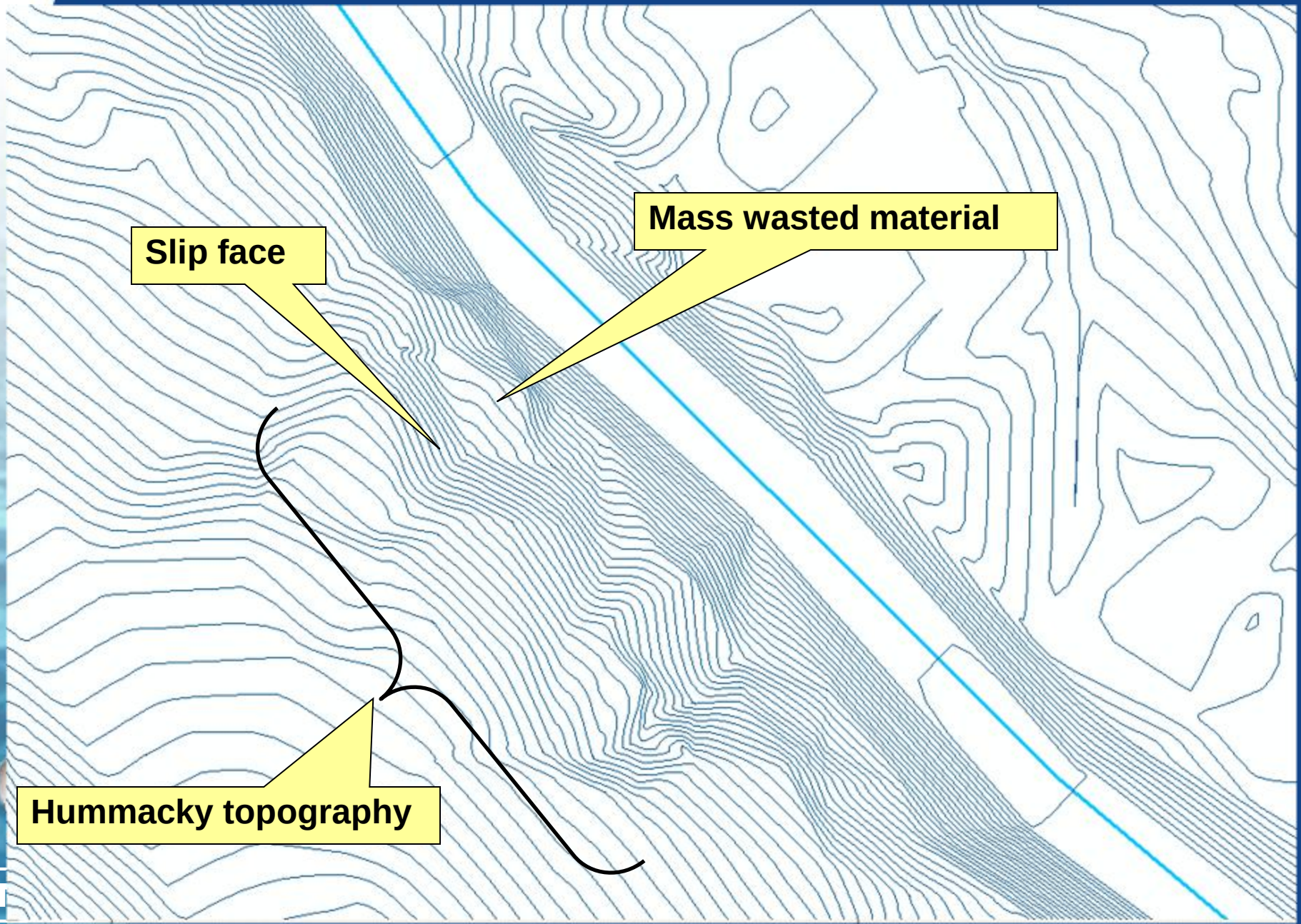
Ten Foot Interval Elevation Contours



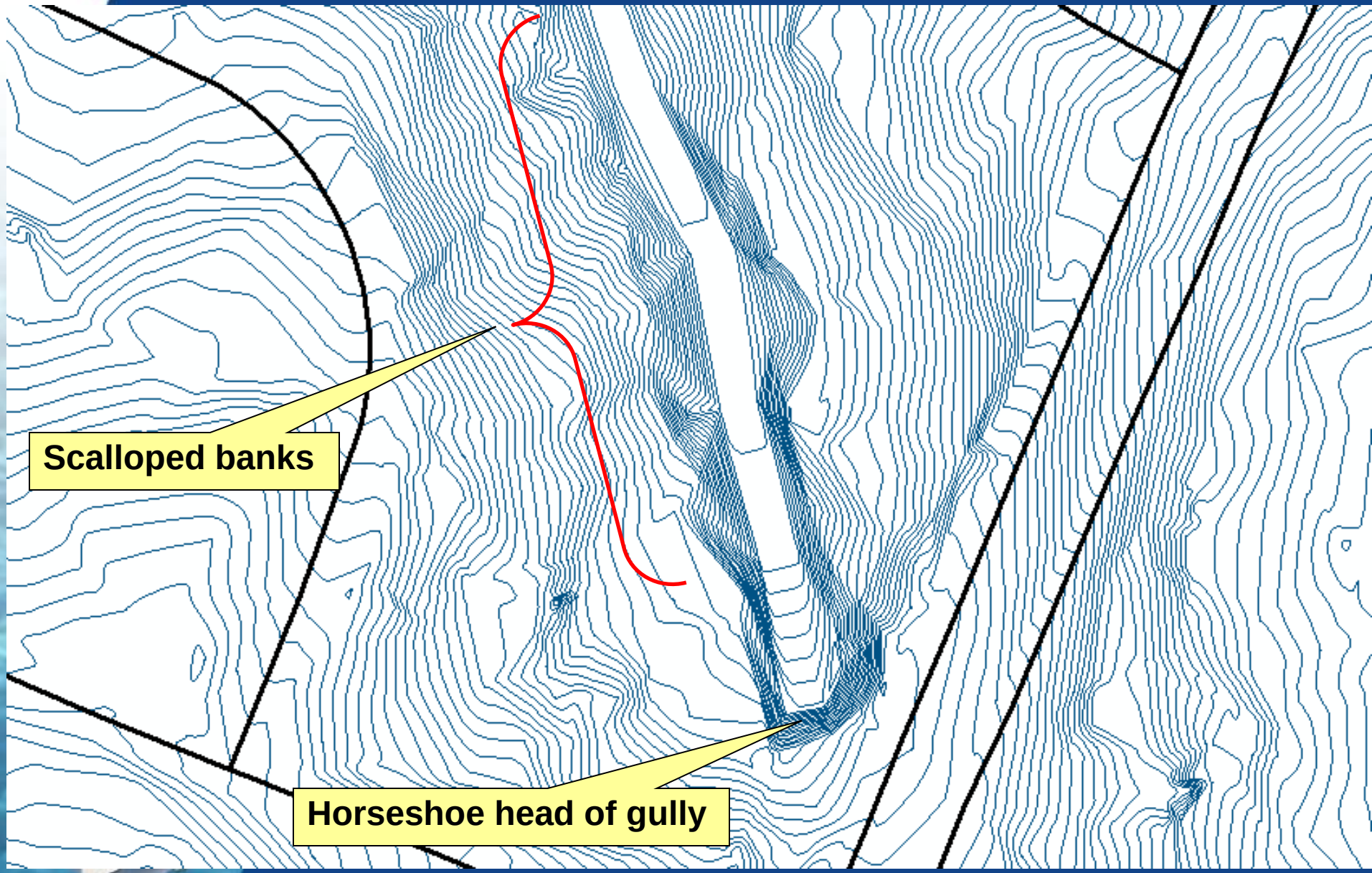
One Foot Interval Elevation Contours



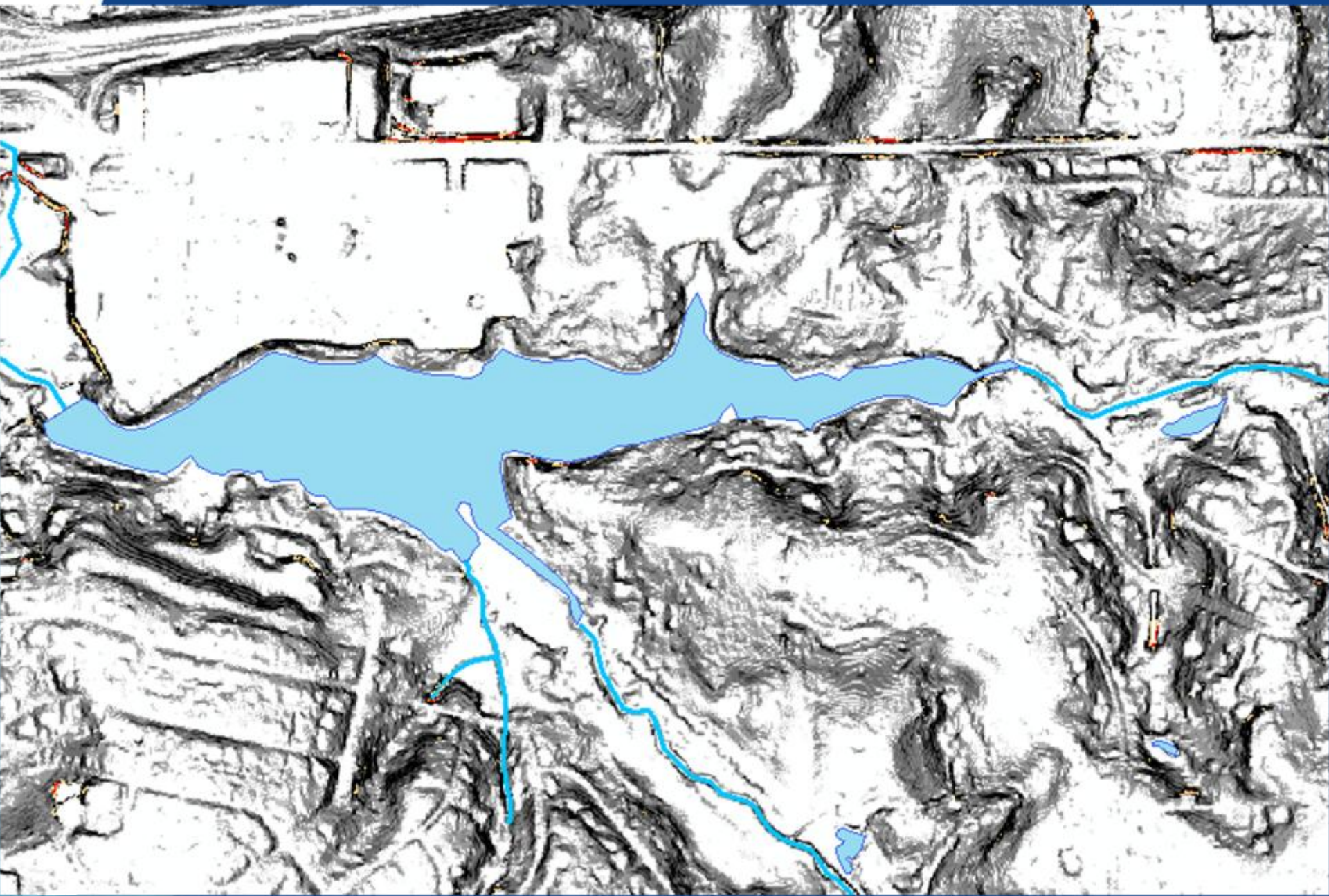
Mass Wasting Hill Slopes



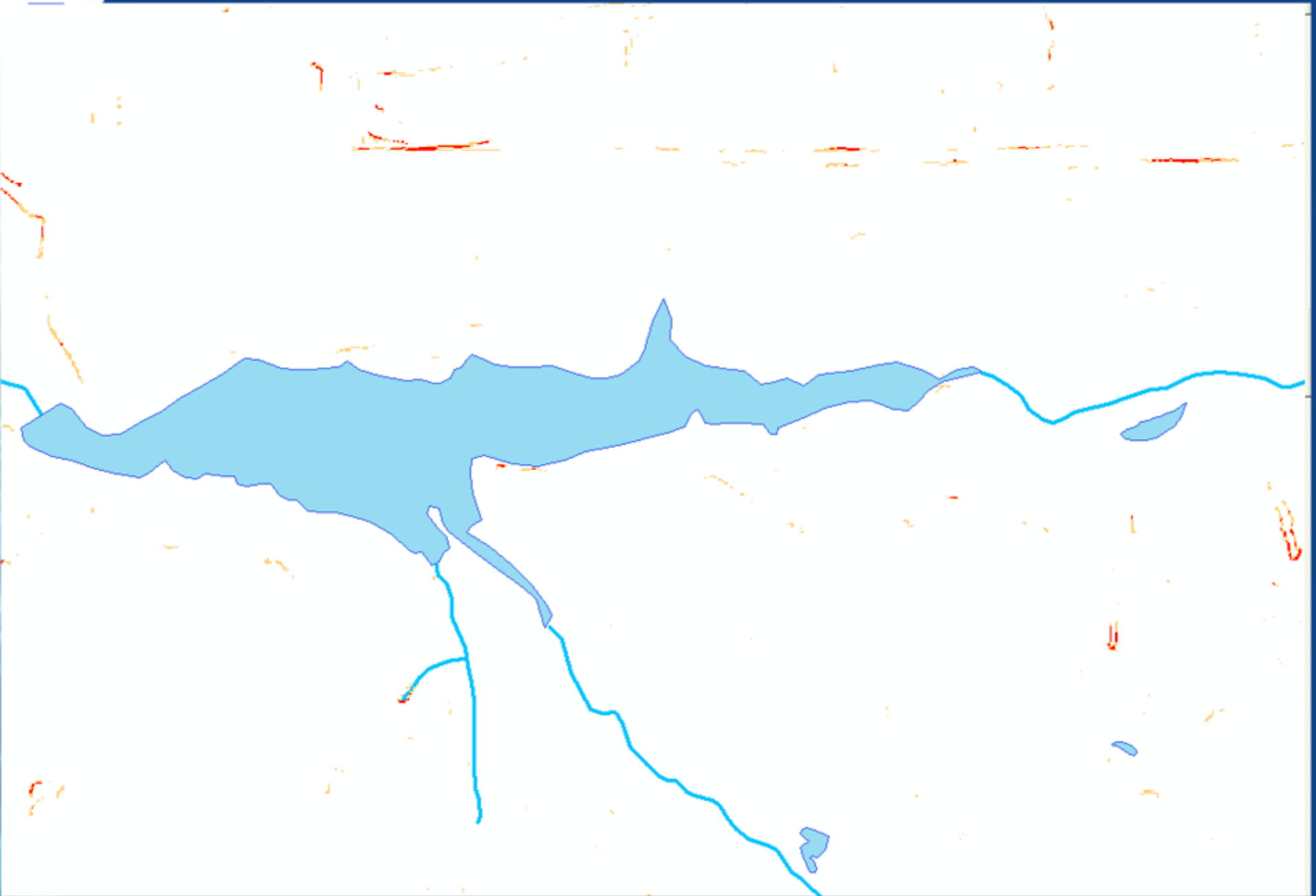
Gullies with Headcuts



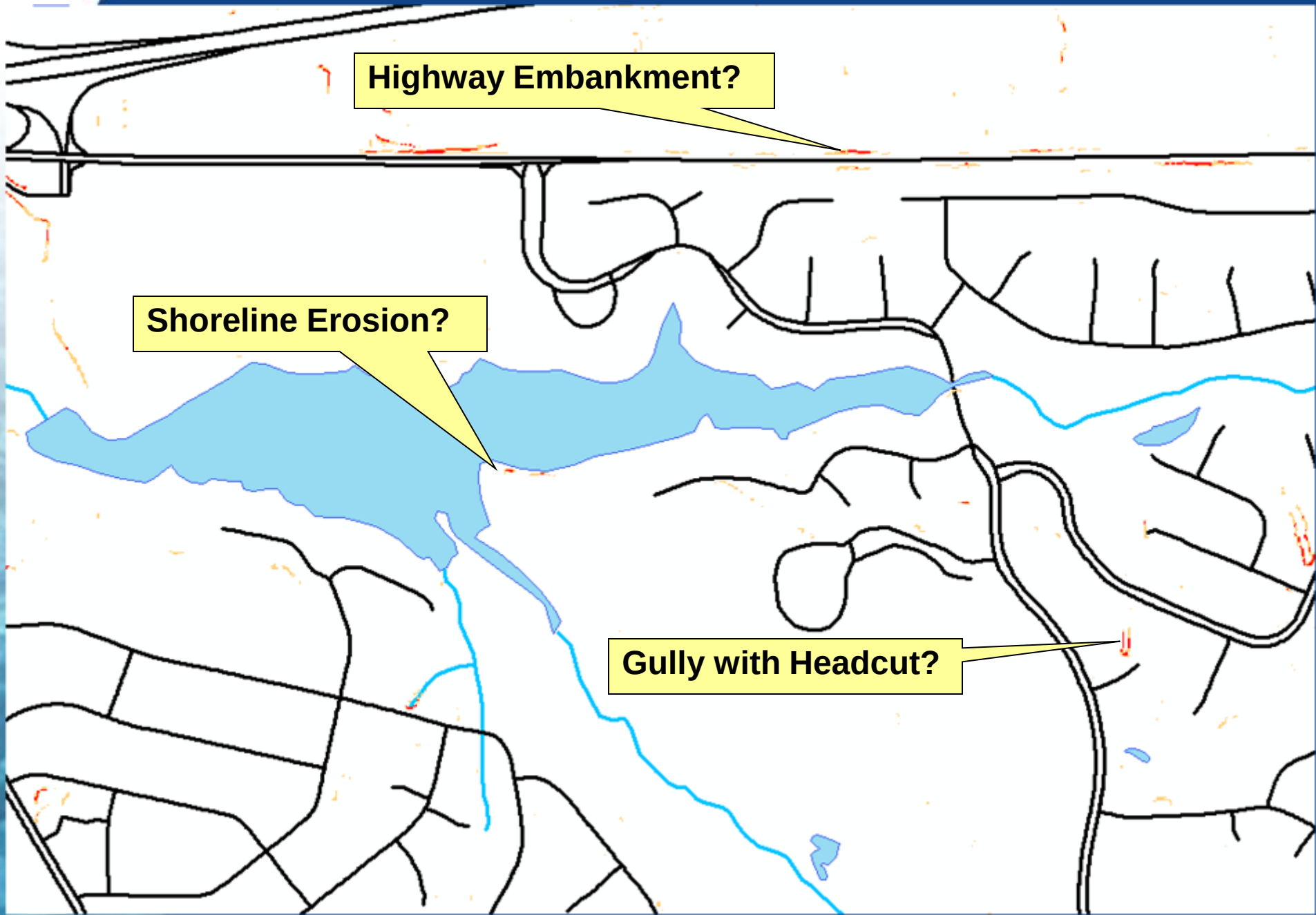
Slope Grid Map: Light = low, Dark = High, Red = Highest



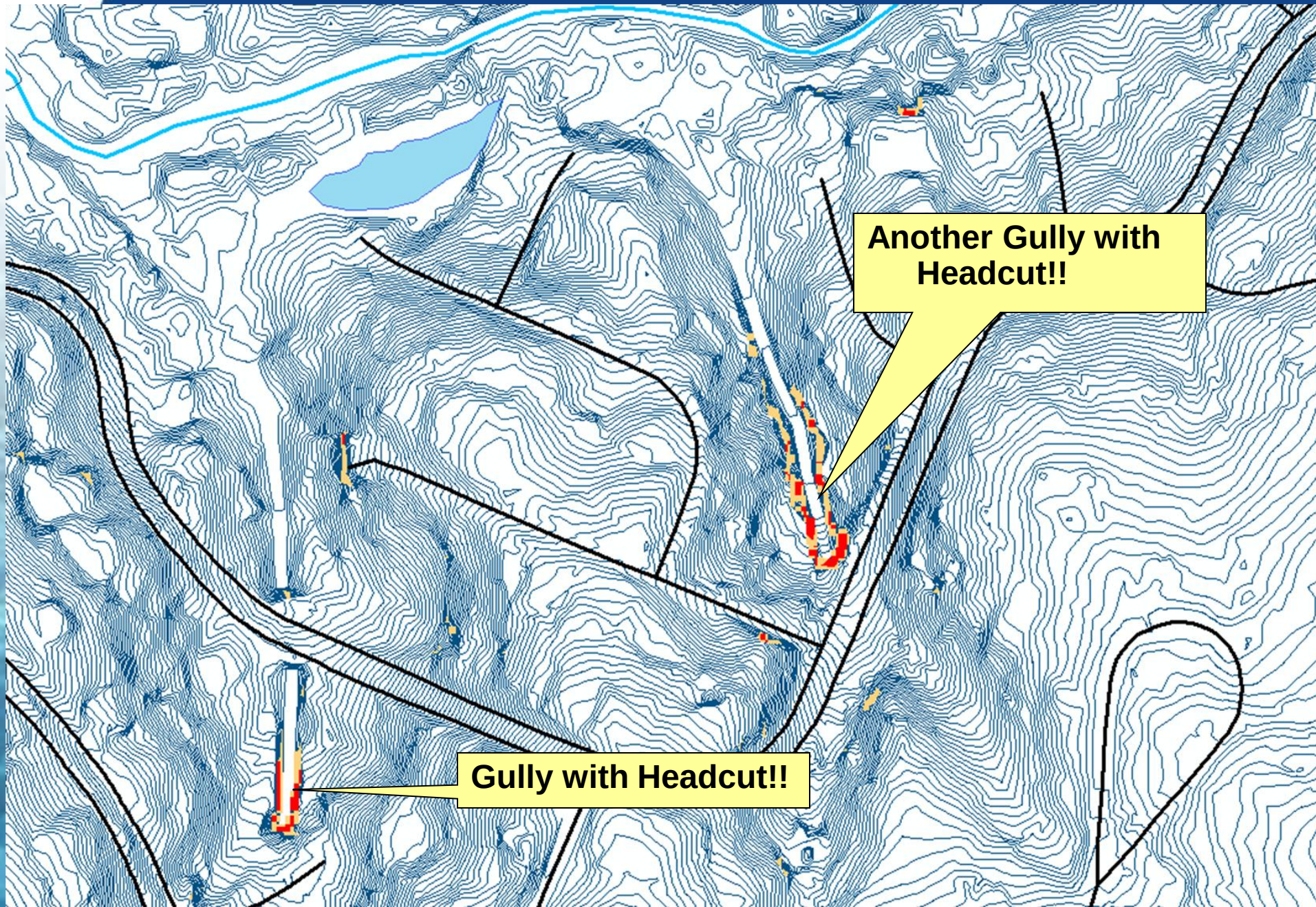
Red = potential severe sediment source, >35 degrees



Select points of interest



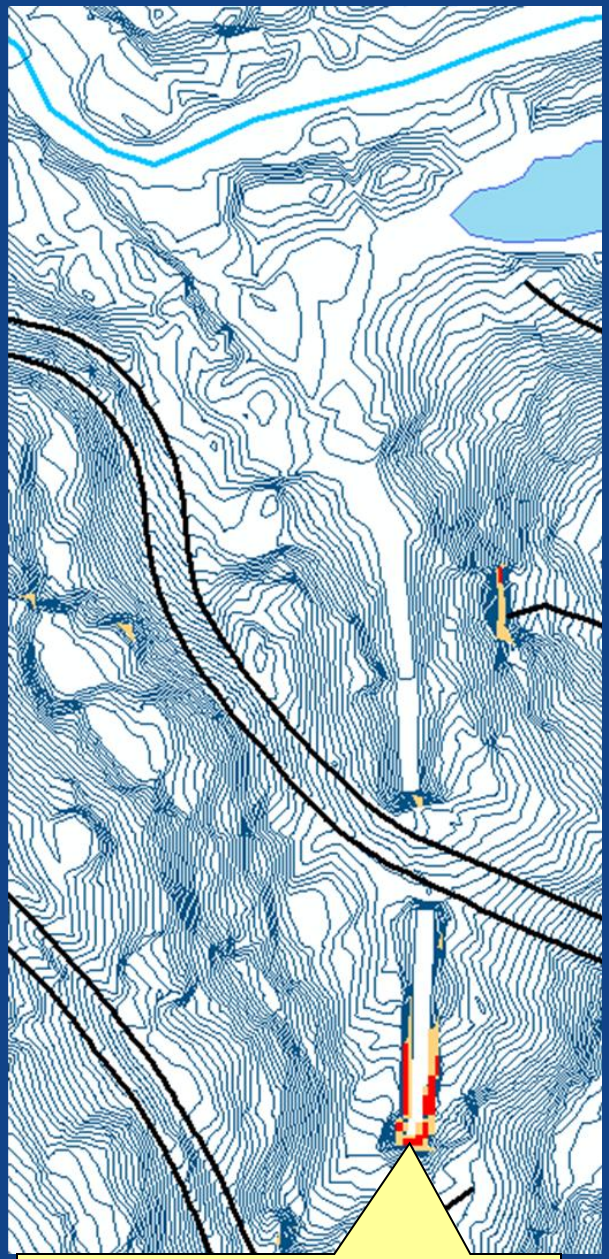
1 Foot Contours



7.5 Min Quad, Aerial Photo, & 1 Foot Contour w/High Slope

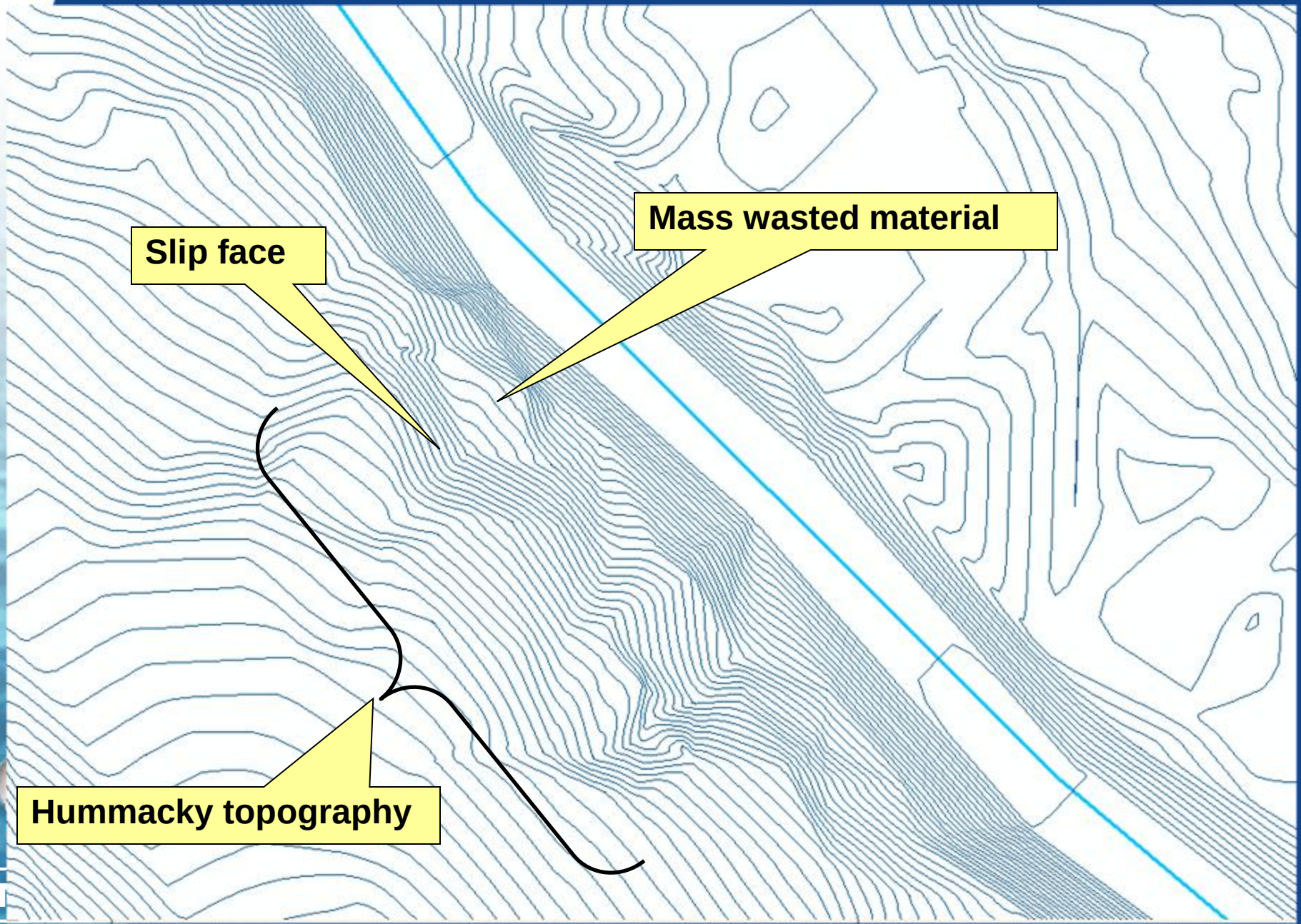
Gully with Headcut ?

Gully with Headcut ?



Gully with Headcut !!

Mass Wasting Hill Slopes



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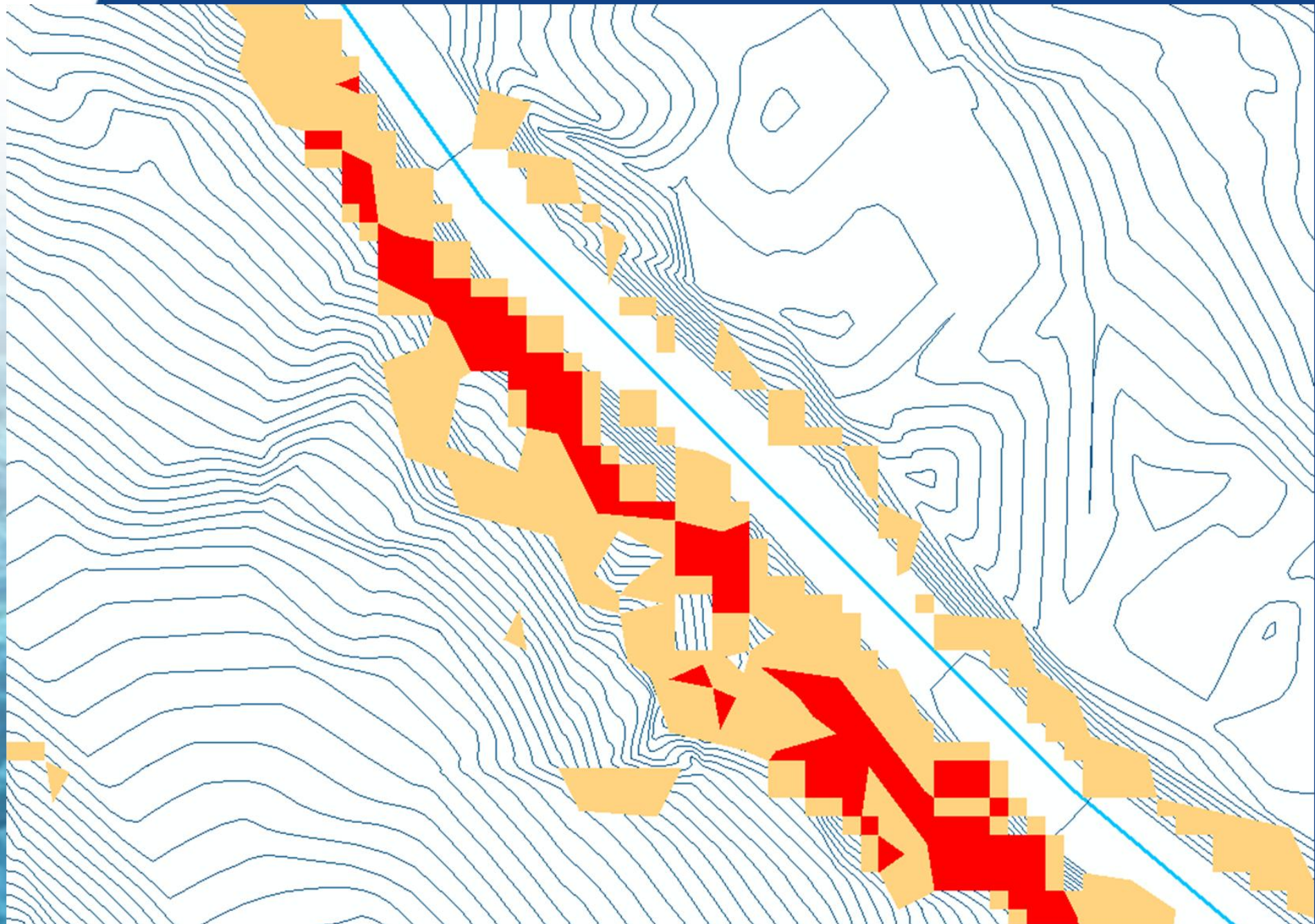
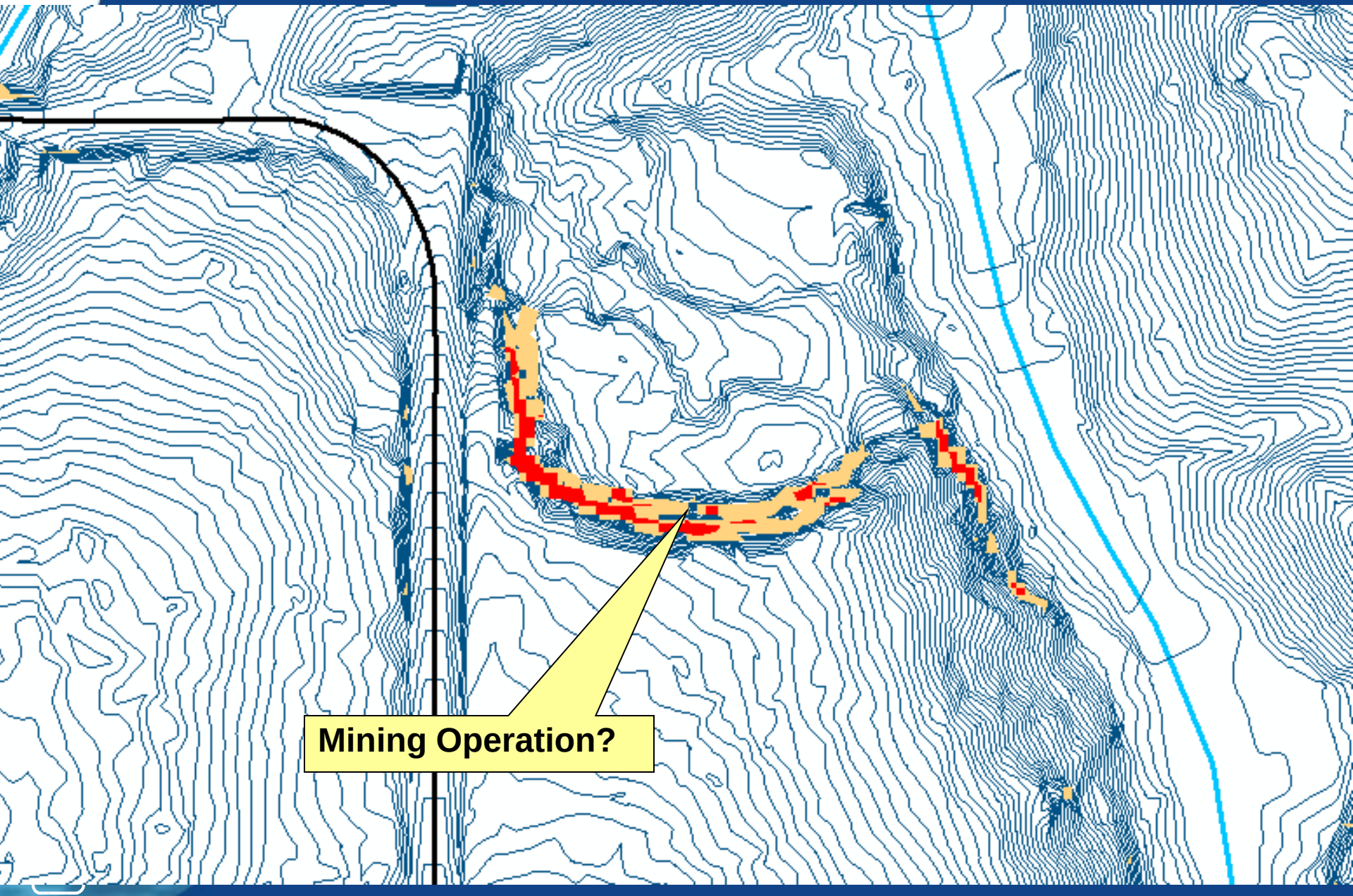


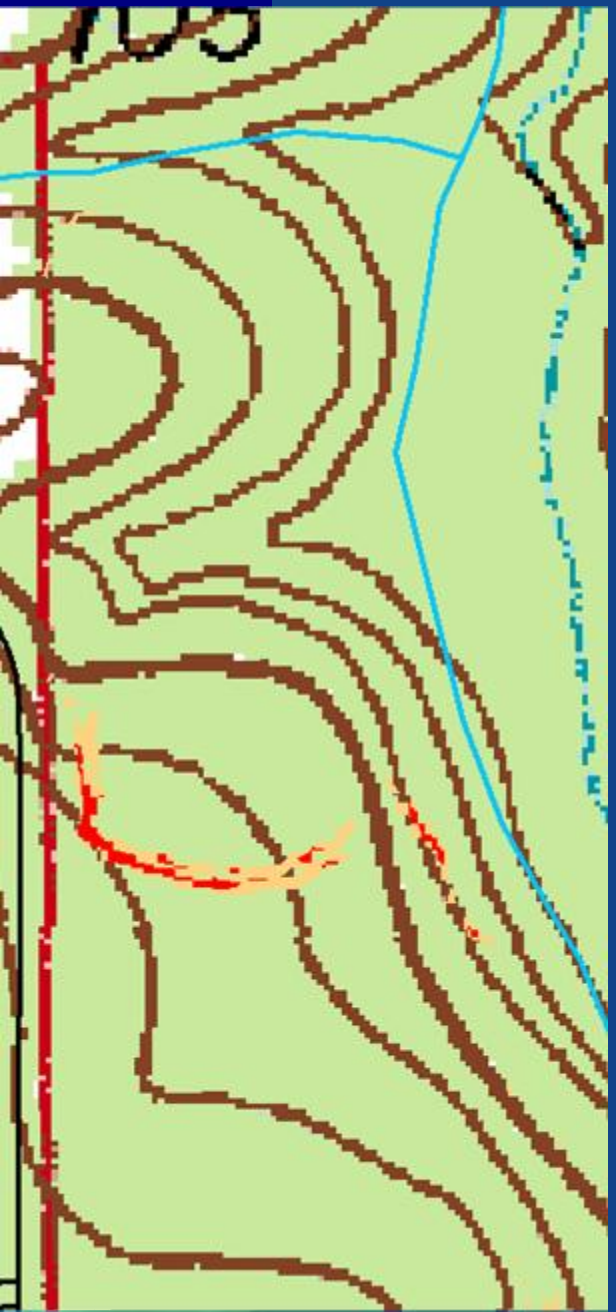
Mass Wasting Hill Slopes

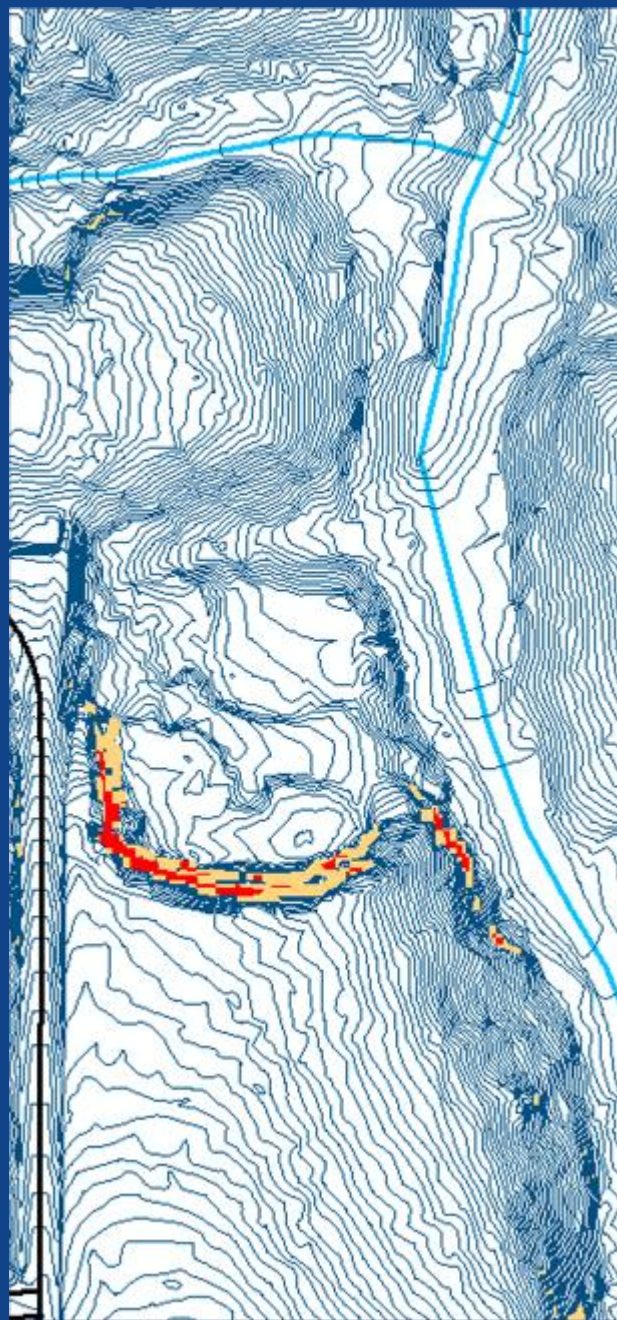
Barren Areas / Mining Operation



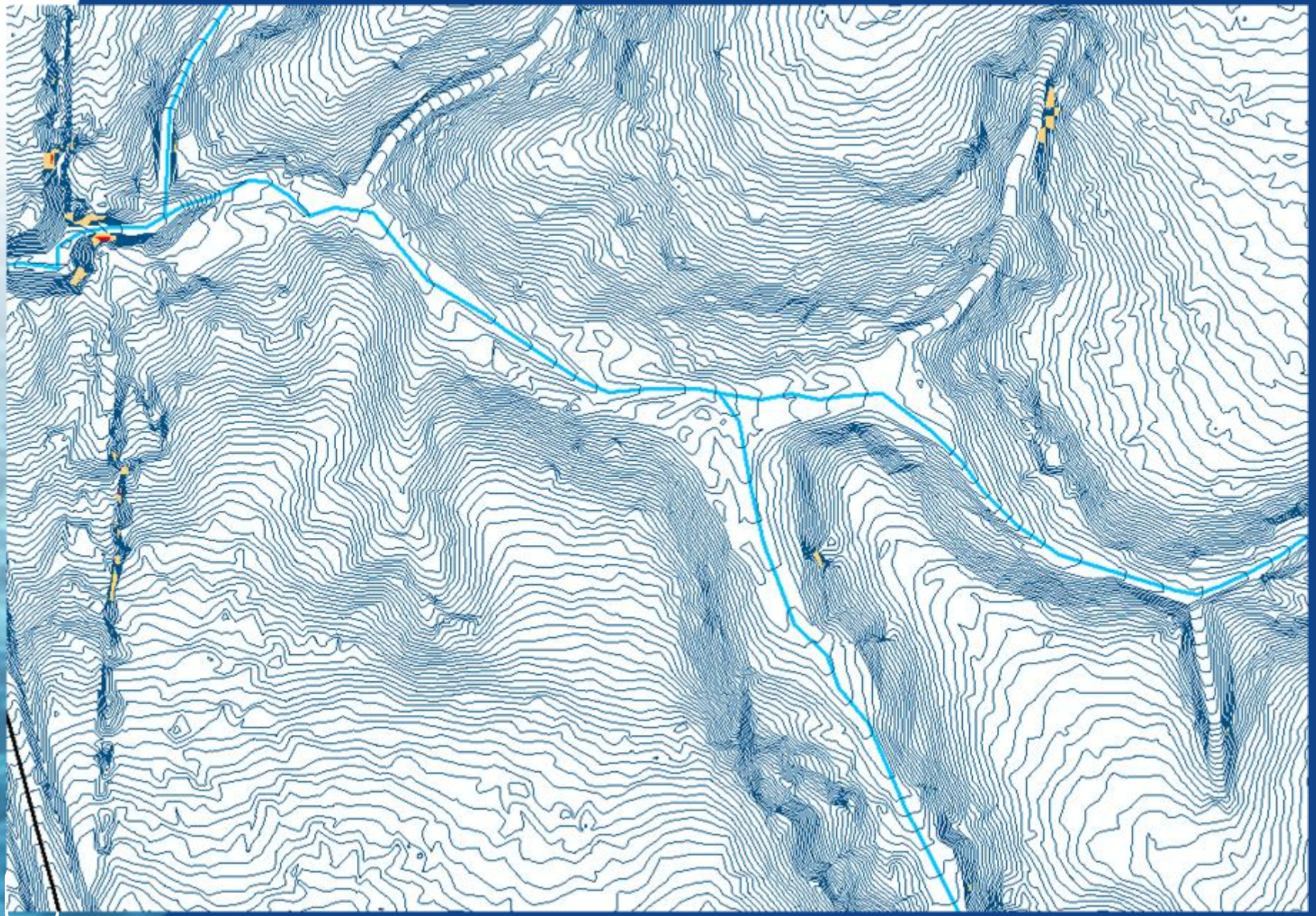
Barren Areas / Mining Operation

7.5 Min Quad, Aerial Photo, & 1 Foot Contour w/High Slope





Places to Cross off the Field Work List



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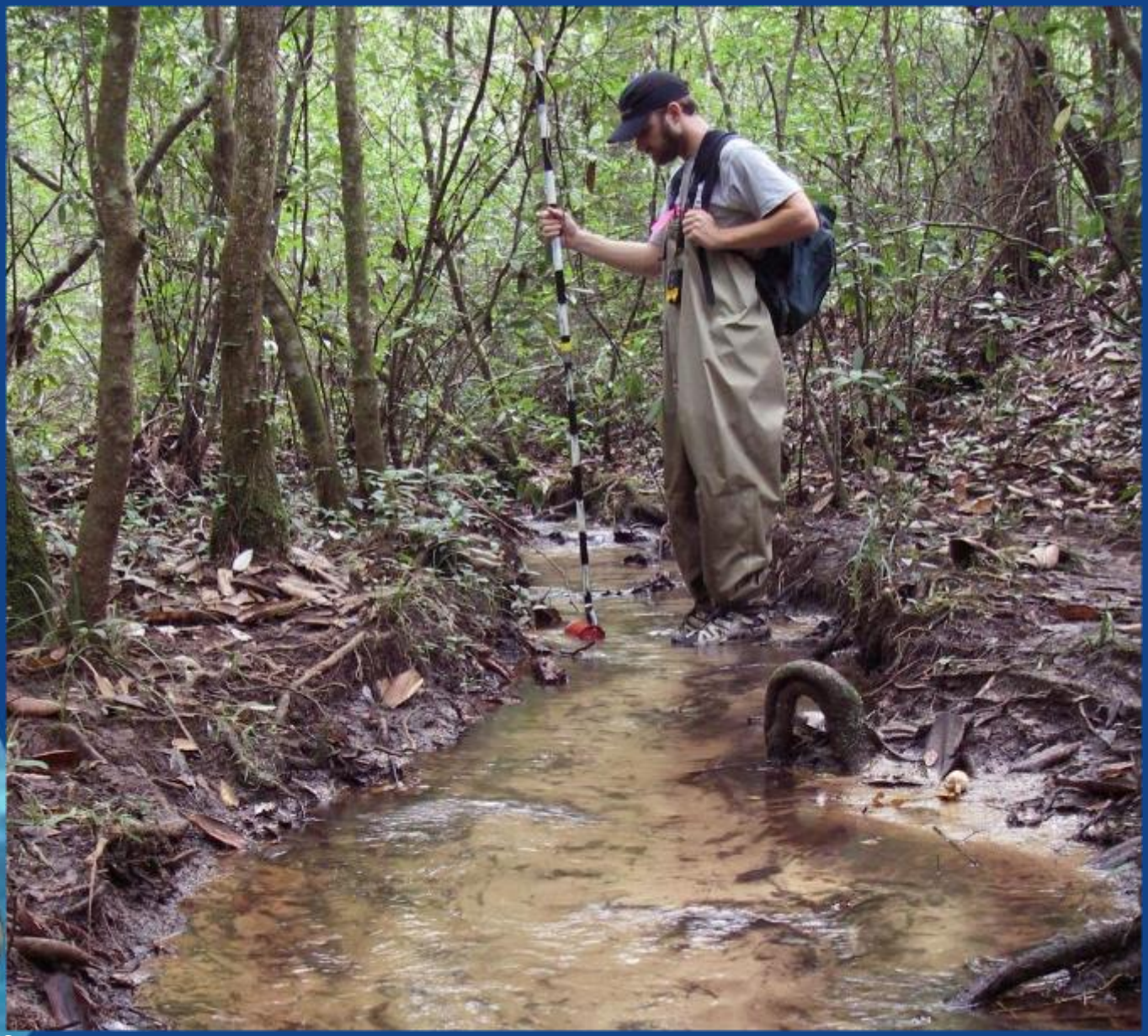

1. Helps in prioritizing locations to investigate.
2. Field time is used more efficiently.
3. A better quality product is provided to the client.

Acknowledgements

This study was funded by the Mobile Bay National Estuary Program.

Many thanks to:

Ashley Campbell of the City of Daphne, Alabama
Carl Pinyerd of Thompson Engineering
Marlon Cook of the Geological Survey of Alabama
Wayne Isphording of the University of South Alabama
John Carlton
Ross Martin of Tetra Tech

Questions?

Related Presentations

Raul Mercado –

HyperSpectral LIDAR/RADAR imagery for water quality monitoring and environmental assessment in ecosystem restoration

Wednesday 10:00

Methods

Problems with Conventional practice:

Streamwalk:

Watershed may be too large; impractical to walk all the streams.

Dry, non-blueline streams, may be sediment sources.

Windshield survey of watershed:

Features of interest may not be near roads. Features of interest may be obscured by vegetation in aerial photos.

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First Step:

- Understanding sediment source types
  - Stream Channel Erosion

First Step:

- Understanding sediment source types
  - Ephemeral waterways –
    - Roadside ditches, dry tributaries, gullies

First Step:

- Understanding sediment source types
  - Rainsplash and rill erosion of bare soils
    - Construction sites, crop land, poorly maintained urban soils.

First Step:

- Understanding sediment source types
  - Mass wasted hill slopes

Understanding sediment source types

- Erosion of unpaved roads

sediment source types

- Lake shoreline erosion
- Stream Channel Erosion
- Ephemeral waterways
  - Roadside ditches, dry tributaries, gullies
- Rainsplash and rill erosion of bare soils
  - Construction sites, crop land, poorly maintained urban soils.
- Mass wasted hill slopes
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